PATENTS • DESIGNS • COPYRIGHT • TRADE MARKS
The Patent Office

INVESTOR IN PEOPLE

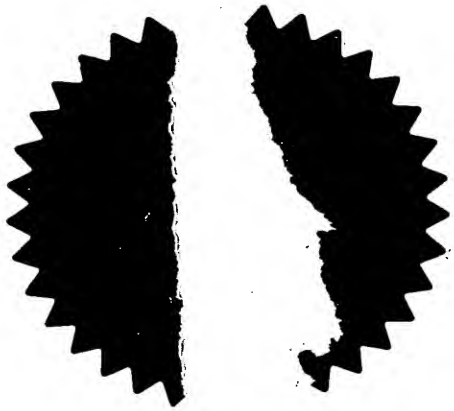
The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.



Signed 

Dated 17 November 2003

Patents Form 1/77

Patents Act 1977
(Rule 16)

The Patent Office

THE PATENT OFFICE
12 JUL 2002
NEWPORT

12JUL02 E732866-1 D02806
P01/7700 0.00-0216175.0

1/77

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet, from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

1.	Your reference	ADT0163	
2.	Patent application number *(The Patent Office will fill in this part)*	0216175.0	12 JUL 2002
3.	Full name, address and postcode of the or of each applicant *(underline all surnames)*	Thames Side - Maywood Limited 17 Stadium Way Reading Berkshire RG30 6BX	
	Patents ADP number *(if you know it)*	8206674001	
	If the applicant is a corporate body, give the country/state of its incorporation	England	
4.	Title of the invention	LOAD ASSEMBLY	
5.	Name of your agent *(if you have one)*	Barker Brettell	
	"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	138 Hagley Road Edgbaston Birmingham B16 9PW	
	Patents ADP number *(if you know it)*	7442494002	

		Country	Priority application number *(if you know it)*	Date of Filing *(day/month/year)*
6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number			

		Number of earlier application	Date of filing *(day/month/year)*
7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application		

8.	Is a statement of inventorship and of right to grant of a patent required in support of this request *(Answer 'Yes' if:* *a) any applicant named in part 3 is not an inventor, or* *b) there is an inventor who is not named as an applicant, or* *c) any named applicant is a corporate body.* *See note (d))*	Yes

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	-
Description	12 + 12
Claim(s)	-
Abstract	-
Drawing(s)	3 + 3

10. If you are also filing any of the following, state how many against each item.

Priority documents	-
Translations of priority documents	-
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	-
Request for preliminary examination *(Patents Form 9/77)*	-
Request for substantive examination *(Patents Form 10/77)*	-
Any other documents *(please specify)*	-

11. I/We request the grant of a patent on the basis of this application.

Signature: Barker Brettell — Date: 11.07.2002

12. Name and daytime telephone number of person to contact in the United Kingdom: Dr. Andrew Tranter — Tel: 0121 456 1364

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 01645 500505
b) Write your answers in capital letters using black ink or you may type them.
c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.
e) Once you have filled in the form you must remember to sign and date it.
f) For details of the fee and ways to pay please contact the Patent Office.

LOAD ASSEMBLY

This invention relates to load assemblies such as may be, although non-exclusively, used to support load cells used to measure loads in tension and for methods of measuring forces using a load cell.

Load cells are commonly of the form of a beam on which a load can be applied which is shaped such that a region of the beam deforms in a known manner. Strain gauges, which exhibit a known change in resistance for a given deformation, can be applied to the region. Therefore, measurement of the resistance of the strain gauges gives an indication of the load on the load cell. One commonly used load cell, the "S-beam" load cell, is of the form of an S-shaped beam, with a thinned out section or sections at or near the centre of the S. The strain gauges are mounted on these thinned out sections. Such a load cell is generally supported by the top of the S and a load applied at the bottom.

It is known in the art to measure the force exerted by a load by suspending the load from a load cell, typically an S-beam load cell, suspended from an anchor point and measuring the known changes in resistance of strain gauges. However, this has the disadvantage that if it proves necessary to remove the load cell, for example in case of a fault in the load cell, then, as the load cell provides the support for the load, the load must be removed from the load cell and otherwise supported.

Furthermore, if the load cell snaps or otherwise breaks the load may fall uncontrollably so in most situations a safety strap must be provided in parallel with the load cell. Unfortunately, such straps have a tendency exert a force or support the load to some extent, which reduces the accuracy of such measurements.

According to a first aspect of the invention, there is provided an assembly for use in suspending loads from a load cell, comprising:

an upper part adapted to be secured to an anchor point and from which a load cell may be suspended; and

a lower part adapted to be suspended from the load cell and from which a load may be suspended,

in which, in use, the assembly may be used in at least two positions, including:

an inoperative position in which the load cell is not fitted, where the lower part and hence the load is supported on the upper part;

and

an operative position in which the lower part and the load are supported only through the load cell and the lower part does not rest on the upper part.

Advantageously, this provides a load assembly that can support a load in the inoperative position but allow the load cell to take the load in the second, operative, position. Accordingly, the load cell may be removed in the inoperative position and replaced or otherwise maintained as necessary. The load cell with which the assembly is adapted to be used with may be an S-beam load cell.

The assembly may conveniently include means adapted to switch the assembly between inoperative and operative positions. This may be lifting means, which is adapted to lift the lower part off the upper part.

Preferably, the lifting means is adapted to lift the lower part by lifting the load cell.

The lifting means may comprise an upper engagement member, by means of which the upper part is adapted to engage the load cell, and a lower engagement member by means of which the lower part is adapted to engage the load cell. The lower engagement member may fix the lower part vertically relative to the load cell, whilst the upper engagement member may allow controlled movement of the load cell relative to the upper part. Such movement may have a vertical component, and may indeed be entirely vertical. Accordingly, at least a portion of the upper engagement member may move vertically relative to the upper part.

In a preferred embodiment, the upper engagement member may be adapted to rotate about an axis. It may have a portion offset from this axis. The upper engagement member may be adapted to engage the load cell at this offset portion. Specifically, the upper engagement member may comprise a cranked shaft.

The upper part may be provided with a series of holes through which the upper engagement member may removably pass. The upper engagement member may be removable and re-insertable from the upper part by sliding along the length of the shaft through the holes. The holes that the offset portion pass in order to remove the upper engagement member may be elongate in order to allow easy removal and re-insertion of the upper engagement member.

At least one of the holes may be in at least one, but preferably two, forks depending from the upper part into the interior thereof. These forks may provide part of the connection between the load cell and the upper part.

The assembly may be adapted to engage the load cell using the offset portion of the upper engagement member. Accordingly, rotation of the upper engagement member may cause the load cell to lift and hence the lower part no longer rests on the upper part. This provides means for switching between the inoperative and operative positions.

The upper engagement member may further comprise a handle, by means of which rotation of the shaft is facilitated. The handle may be connected perpendicularly to the first shaft, possibly at an end thereof. A handle, especially if it extends away from the axis of the shaft further than the offset portion, enables the load to be lifted into the operative position by a user.

The handle may be securable to the upper part such that, in use, the upper engagement member cannot rotate. The handle may be, in the operative position, securable to the upper part. The secural of the handle to the upper part may be achieved by means of a screw passing through a hole in the handle and being received in a captive nut in the upper part.

The lower part may be provided with at least one, but preferably two, forks depending therefrom, which may engage the lower engagement member. The lower engagement member may comprise a further shaft introduced through the, or each, of the forks of the lower part.

The assembly may be positionable in a further, "transit", position in which the lower part is secured to the upper part. The further shaft may secure the upper part to the lower part. In the transit position, the further shaft may pass through at least one of the, or each, fork and through a secural hole in the upper part. Furthermore, in the transit position, the upper engagement member may be secured to the upper part.

Accordingly, in the transit position the parts of the assembly are protected against movement relative to one another.

The upper part may include a captive nut by means of which the upper part is secured to the anchor point. The lower part may include a captive nut by means of which it is adapted to be connected to the load.

The upper part may be of the form of a frame surrounding an interior space, with an orifice providing communication between interior and exterior. The lower part may, in the inoperative position, rest on inner walls of the upper part in the region of the orifice. Preferably, the assembly is arranged so that the lower part cannot fall through the orifice. This means that should part of the assembly or the load cell fail, the load will still be supported.

According to a second aspect of the invention, there is provided a combination of an assembly for use in suspending loads from a load cell and a load cell, comprising:

a load cell;

an upper part adapted to be secured to an anchor point and from which a load cell may be suspended; and

a lower part adapted to be suspended from the load cell and from which a load may be suspended,

in which the combination can be used in at least two positions, including:

an inoperative position in which the lower part and hence the load is supported on the upper part

and

an operative position in which the lower part and the load are supported only through load cell and the lower part does not rest on the upper part,

and in which the combination further comprises an upper engagement member, by means of which the upper part is adapted to engage the load cell and allow controlled movement of the load cell between the operative and inoperative positions, and a lower engagement member by means of which the lower part is adapted to engage the load cell and fix the lower part vertically relative to the load cell.

The load cell may be an S-beam load cell. Preferably, the load cell is adapted to pivot about its connection to the upper part, which may be the offset portion of the upper engagement member. The surface of the upper part upon which the lower part, in the inoperative position, rests may substantially define a section of the surface of a sphere with a centre at the point about which the load cell is adapted to pivot.

The load cell may comprise one or more loading adaptors by means of which the load cell engages the engagement members. Each loading adaptor may be fixed to an end of the load cell and may define an aperture. The aperture may have bevelled sides such that the loading adaptor may pivot about all three axes relative to any member introduced into the aperture.

The combination may further have any of the features described above in relation to the assembly of the first aspect of the invention.

According to a third aspect of the invention, there is provided a method of measuring the force due to a load, comprising:

a) suspending the load from an assembly;

b) fitting the assembly with a load cell; and

c) causing the assembly to transfer the load such that it is being supported by the load cell.

The assembly may be the assembly of the first aspect of the invention.

The step of causing the assembly to transfer the load to the load cell may comprise lifting a body associated with the load cell at least partially off a rest. The body may lift completely off the rest. The rest may, when the body is resting thereon, support the load.

Lifting may be achieved by means of rotation of a cranked shaft. The cranked shaft may, in use of the assembly, be secured against unwanted rotation.

The method may further comprise the step of allowing the body to fall back onto the rest should part of the assembly fail. Furthermore, the method may include the step of lowering the body back onto the rest such that the load cell may be removed.

The invention will now be described by way of example, with reference to the accompanying drawings, in which:-

Figures 1a and 1b show the outer body of an assembly according to the invention, in front and side central cross section, respectively;

Figure 2a shows one of the loading adaptors used in the invention in front plan view;

Figure 2b shows the loading adaptor of figure 2a in cross section along line 2B;

Figure 3 shows the load cell assembly of the assembly of figure 1;

Figures 4a and 4b show front and side cross sections, respectively, through the inner body of the assembly of figure 1;

Figure 5 shows an assembly in the transit position;

Figure 6 shows an assembly fitted with a load cell assembly in the non-working position; and

Figure 7 shows an assembly in the working position.

A loading assembly according to the present invention and as depicted in the accompanying drawings comprises two parts: an upper part comprising an outer body 10 and a lower part comprising an inner body 12. Each of these comprises means to keep captive a nut such that by introduction of a threaded rod (not shown) or similar the respective part may be introduced into the load path.

The outer body 10 is of the form of a generally planar frame surrounding an interior 30. It is to be mounted vertically and is elongate in a vertical

direction. It comprises, at its top end, a suspension hole 14 in which nut 16 is held captive by circlip 18 held in circumferential groove 20. Accordingly, a rod may be introduced from above the outer body such that the outer body 10 and hence the assembly may be suspended from an anchor point. Depending from the top of the interior 30 of the outer body 10 are two parallel vertical forks 34, hereinafter referred to as the "upper" forks 34. Each fork has an elongate hole 52 formed through it.

An opening 22 at the bottom of the outer body 10 allows connection of a load to the inner body, which is contained within the interior 30 of the outer body 10. The walls of the outer body 10 surrounding the lower opening 22 define a section of the surface of a sphere, with a centre point 36 between the two forks 34. As will be described hereinbelow, this enables a load to swing about the centre point 36 as is likely will happen with a suspended load.

The inner body 12 is of the form of a horizontal bridge portion 24 with two parallel spaced apart forks 26. These forks shall hereinafter be referred to as the "lower" forks 26. The inner body 12 has in the bridge portion 24 a nut 28 again held captive by a circlip 30 in circumferential groove 32. In this case, a rod may be introduced below such that a load may be suspended from the inner body. The lower forks 26 each have a hole 40 passing through them.

When the assembly is supplied to a user, it is in the transit position depicted in figure 5. Inner body 12 is held secure to outer body 10 by means of a lower engagement member of the form of a lower shaft passing through one of the fork holes 40 and a lower transit hole 42 in the outer body. Washers and split pins (depicted as 46) hold the lower shaft in place.

An upper engagement member of the form of a cranked upper shaft 58 is also provided. The upper shaft 58 has a first arm 54, which rests in first 48 and second 50 upper shaft holes on opposite sides of the walls of the upper body. The upper shaft 58 also rests in the elongate holes 52 in the upper forks 34. Accordingly, it is necessary that these holes lie along a common, and in this case horizontal, axis. The first arm 54 of the upper shaft has a cranked portion 56, which in use and in this transit position, sits between the upper forks and is displaced vertically upwards with respect to the axis of the first arm 54. The second upper shaft hole 50 and the elongate holes 52 in the upper forks 34 are necessarily elongate due to the necessity to allow insertion of the upper shaft 58 and more particularly the cranked portion 56 through the second upper shaft hole 50.

The end of the first arm 54 that passes through first hole 48 is secured by means of split pin and washer 62. The cranked upper shaft 58 has a second arm 60, which extends perpendicularly from the end of the first arm normally adjacent to the second upper shaft hole 50. In the transit position, this second arm 60 is secured to the upper body by means of a screw 64 passing through second arm hole 66 and into captive nut 68 retained within outer body 10. The captive nut 68 is positioned so that, in the transit position, the second arm 60 is generally vertical.

A user is also separately supplied with a load cell assembly 70 as shown in figure 3. The load assembly comprises an S-beam load cell 72 as are well know in the art. The load cell 72 is of the form of an S-shaped beam, with recesses 76 in the crooks of the S. A thinned out section 78 is provided in the centre of the S, in which the thickness in the plane of the S is greatly reduced. On this thinned out section strain gauges are mounted, electrically connected to form a bridge. The thinned out section 78 is then welded over to provide the strain gauges with protection from

the elements. Electrical connections to the strain gauges are provided by means of a cable 80. This type of load cell 72 is well known in the art and is used due to its reliability and predictability.

Recesses 82 are provided in the top and bottom of the S of the load cell into which loading adaptors 84a, 84b are inserted to form the assembly. The loading adaptors (depicted as 84 in figures 2a and 2b) each comprise a body section 86 having aperture 90. The aperture 90 has curved walls, which means the adaptor 84 is allowed to rock about a shaft introduced into the aperture 90 about all three axes. The adapter 84 also has a plug 88 depending from it, whereby it is mated to load cell 72.

The user wishing to install the load cell invention of this embodiment installs the assembly in the load path in the above-described transit position by screwing threaded rods, connected to an anchor point and to the load to be suspended, into the captive nuts 16, 28 in the upper 10 and lower 12 bodies respectively. The user then removes upper 58 and lower 44 shafts, and offers the top loading adaptor 84a of the load cell assembly 70 up to the upper forks 34. Upper shaft 58 is replaced in the upper body 10 in the position shown in figure 6. In this "inoperative" position, the upper shaft is replaced in the upper body rotated by 180 degrees about the axis of the first arm 54 relative to the transit position.

Accordingly, the cranked portion 56 now lies vertically below the axis of the first arm 54, and engages the recess 90 of the upper loading adaptor 84a. The inner body 12 is then attached to the lower loading adaptor 84b by means of lower shaft 44 passing through lower forks 26 and recess 90 of lower loading adaptor 84b. At this point, the load cell 72 is not under load as the lower body 12 is resting on the lower interior surface of the outer body. The assembly is now in the position shown in figure 6.

In order to transfer the load onto the load cell 72 the second arm 60 of the upper shaft 58 is rotated about the first arm 54 such that it is back in the original transit position. This forces the cranked portion 56 to rise, taking the load cell assembly 70 and inner body 12 with it. Accordingly, in the "operative" position shown in figure 7, the load now acts through the load cell 72 and hence measurement of the load acting on the assembly is possible. Screw 64, which previously held the second arm 60 fixed relative to the upper body 10 in the transit position, is again used to secure the second arm 60 to the upper body 10 such that the upper shaft 58 does not move unexpectedly in use of the load assembly. The load, and hence the load cell assembly, is able to swing a certain amount in each direction due to the spherical walls surrounding the lower orifice 22 in the upper body.

Once the load assembly has been installed, it may be necessary to remove the load cell assembly 70, for example for maintenance of the load cell 72 or if the load cell 72 fails. In such a case, the screw 64 is removed and the second arm 60 rotated through 180 degrees to the non-working position depicted in figure 6. As inner body 12 now rests on outer body 10, the load acts through the two bodies 10, 12 and not through the load cell assembly 70. Load cell assembly 70 accordingly can be removed and replaced as necessary and then the second arm 60 rotated back 180 degrees to the working position and secured with screw 64.

Similarly, in the unfortunate case where the load cell assembly 70 separates (for example, if the load cell 72 breaks) in some way, the inner body 12 will no longer be held by the load cell assembly 70 and will fall until it hits the outer body 10. Hence, the load will simply be transferred from being held by the load cell assembly 70 being supported by the outer body 10. This removes the need for a separate safety strap.

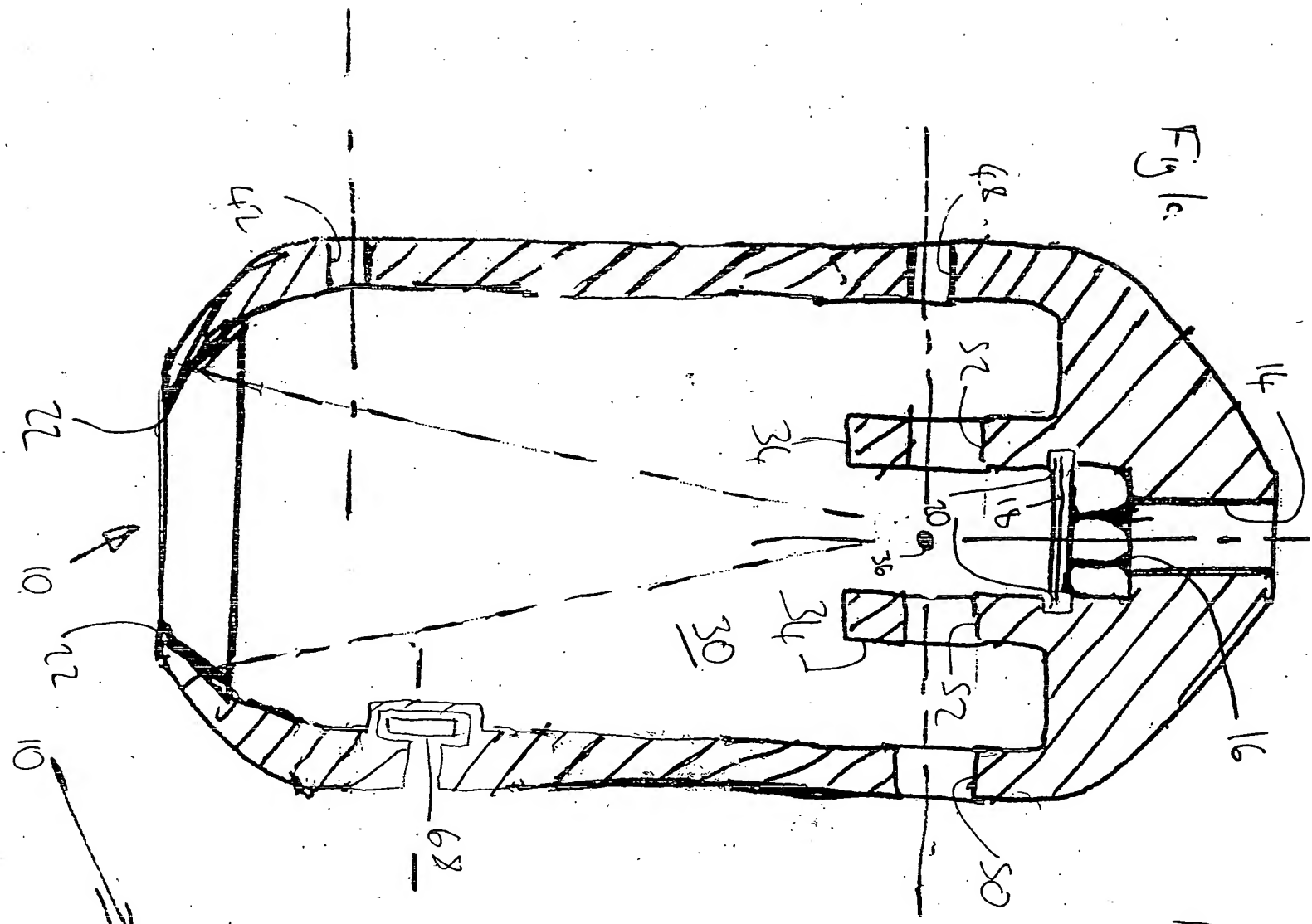


Fig 1a

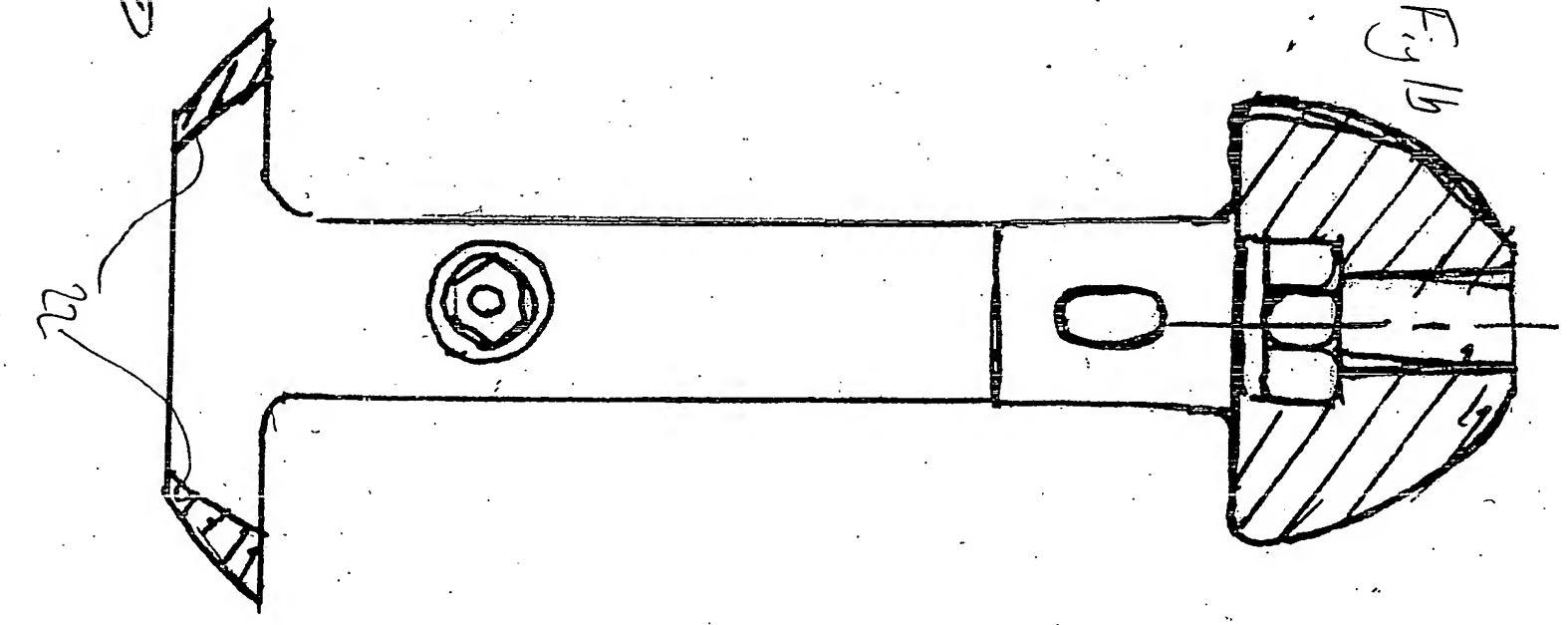


Fig 1b

Fig 2a

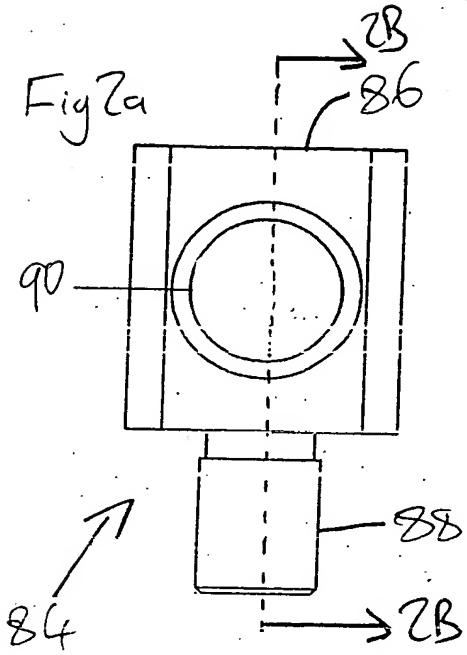


Fig 2b

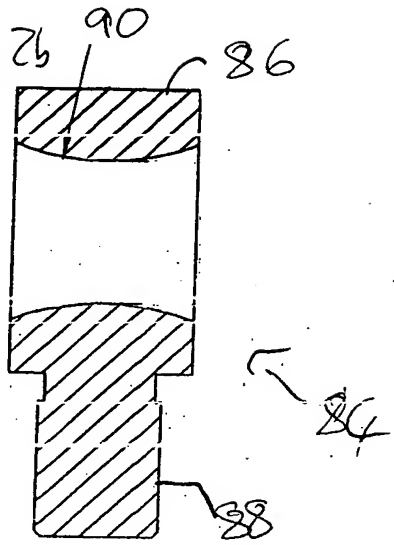


Fig 3

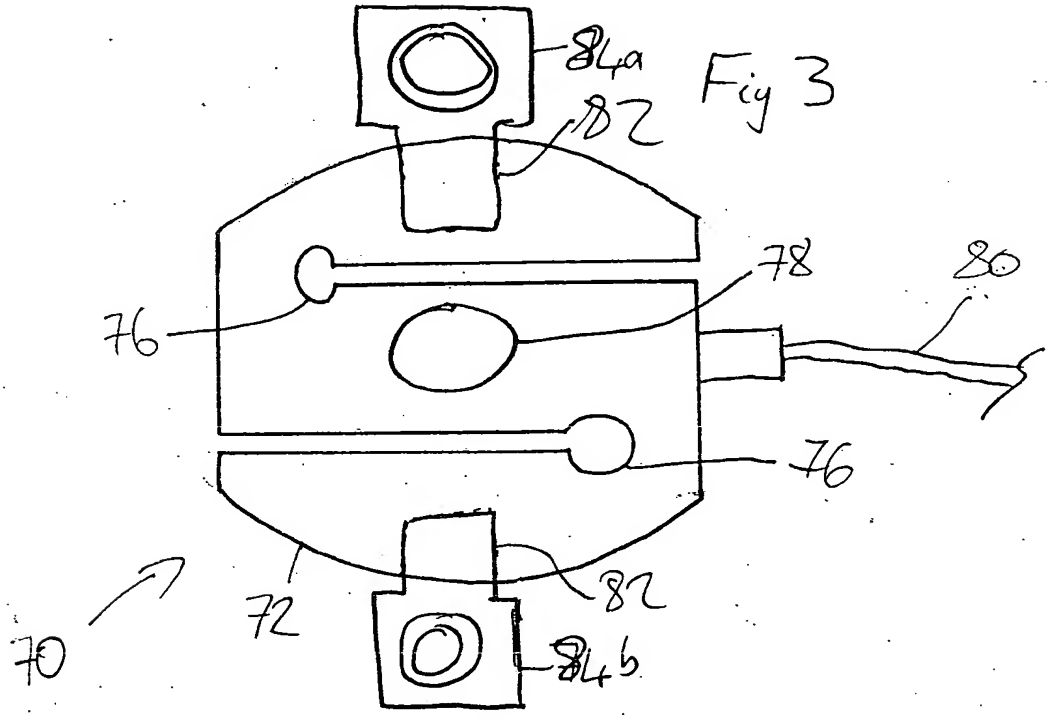


Fig 4a

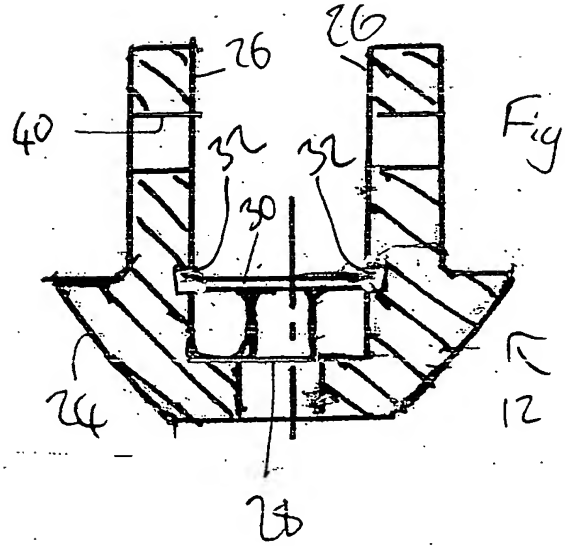
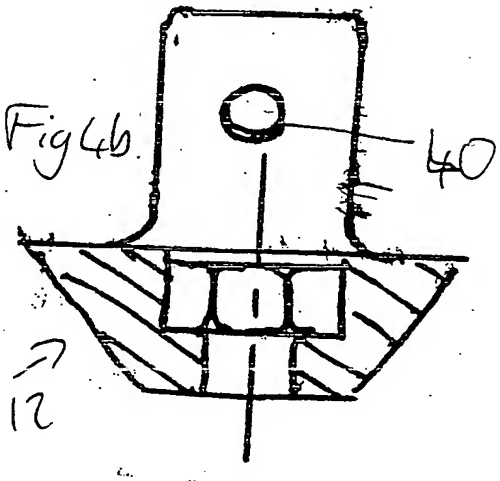


Fig 4b



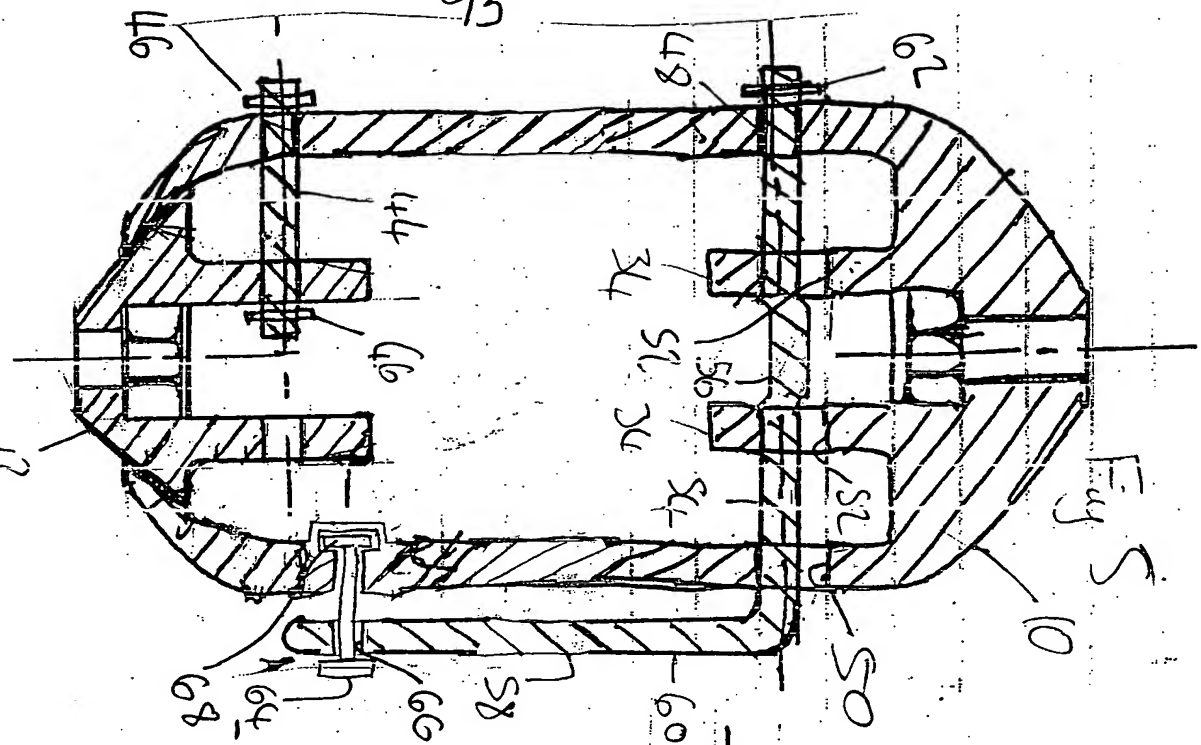


Fig 5

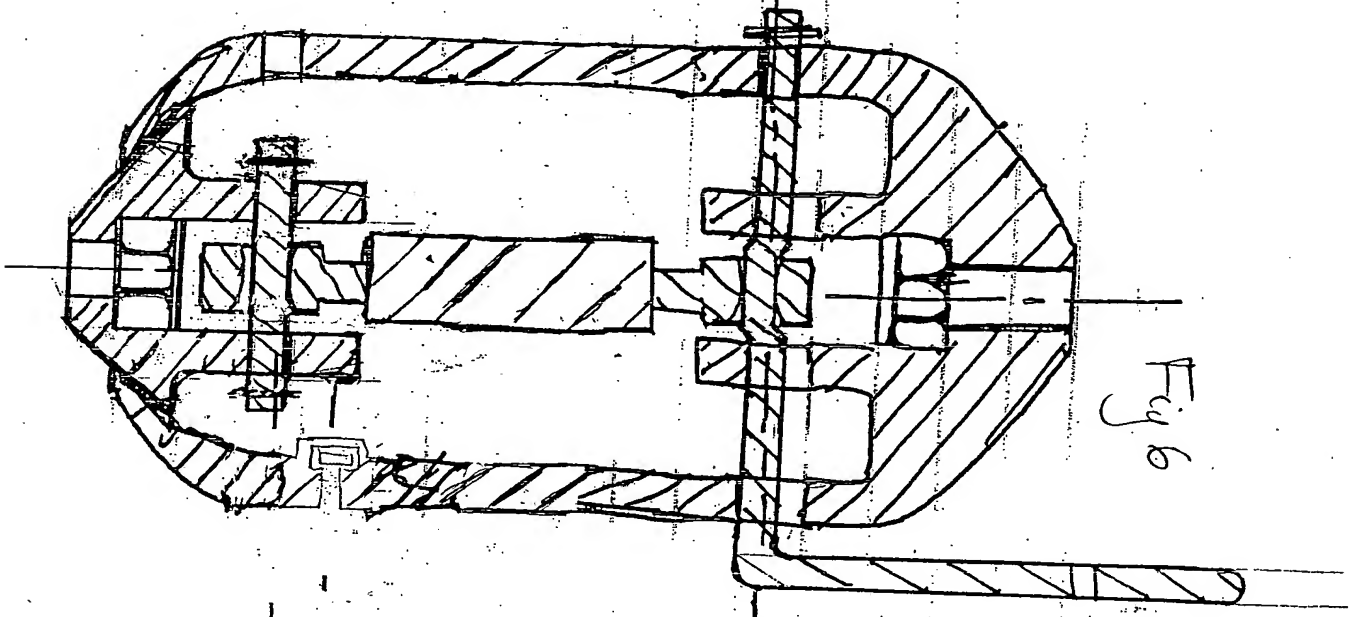


Fig 6

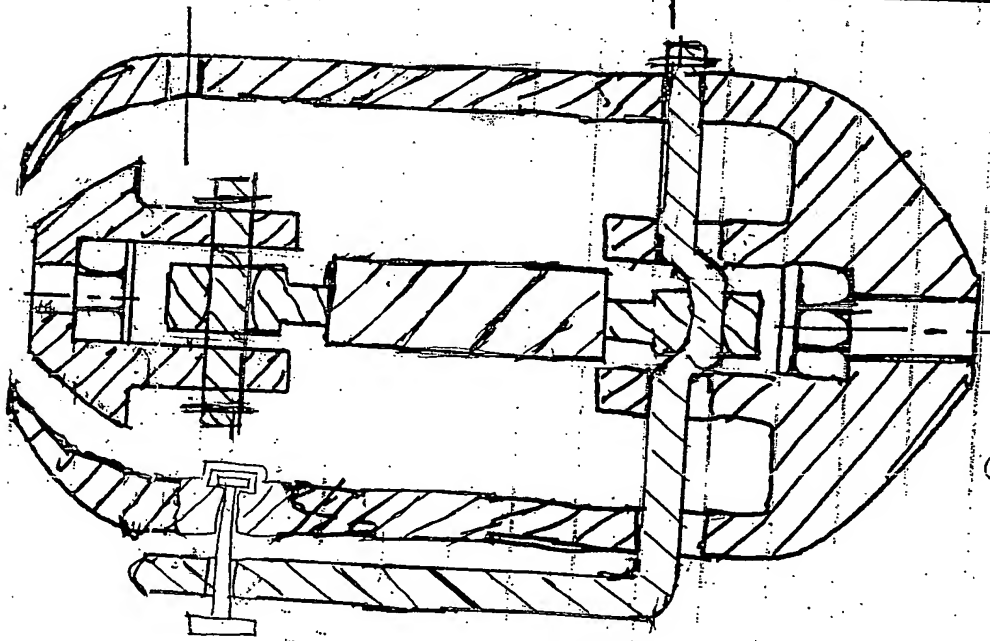


Fig 7